ECE 5020 Lecture 1 Definitions

Blaine Swieder

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1 Foundations of DSP Part I

Definition 1.1 (Signal)**.** *A* ***signal*** *is defined as any physical quantity that varies with time, space, or any other independent variable or more than one variable.*

Definition 1.2 (System)**.** *A* ***system*** *is an entity (physical/logical/software) that performs an operation on a signal (signal processing) and is formed with the interconnections of elements or subsystems that map the system inputs (I) to the outputs (O). In a signals context, a system is essentially a processor of signals (signal processor) or it could also be a source for another signal (signal source).*

Definition 1.3 (Continuous-Time (CT) Signals)**.** ***Continuous-Time (CT) Signals*** *are signals that are defined at every time instant $t \in \mathbb{R}$. Both inputs $u(t)$ and output signals $y(t)$ are continuous in time.*

Definition 1.4 (Discrete-Time (DT) Signals)**.** ***Discrete-Time (DT) Signals*** *are signals that are defined at discrete-time instants $nt, n \in \mathbb{Z}$. Both inputs $u(n) := u(nT)$ and outputs $y(n) := y(nT)$ are discrete in time where $T \in \mathbb{R}$ is generally a fixed "sampling time."*

Definition 1.5 (Analog Signals)**.** ***Analog Signals*** *are functions of continuous-time variables (time/space) and their amplitude can take on any value in a continuous range.*

Definition 1.6 (Digital Signals)**.** ***Digital Signals*** *are functions of discrete variables (time/space) and their amplitude can only be from a finite set of possible values.*

Definition 1.7 (Analog Signal Processor)**.** *An* ***analog signal processor*** *performs operations directly on analog signals and generate analog signals.*

Definition 1.8 (Digital Signal Processor)**.** *A* ***digital signal processor*** *performs operations on digitized signals (A/D Conversion) and may or may not yield analog output (D/A Conversion).*